

# NISTTech

## Device & Method for Microfluidic Flow Manipulation

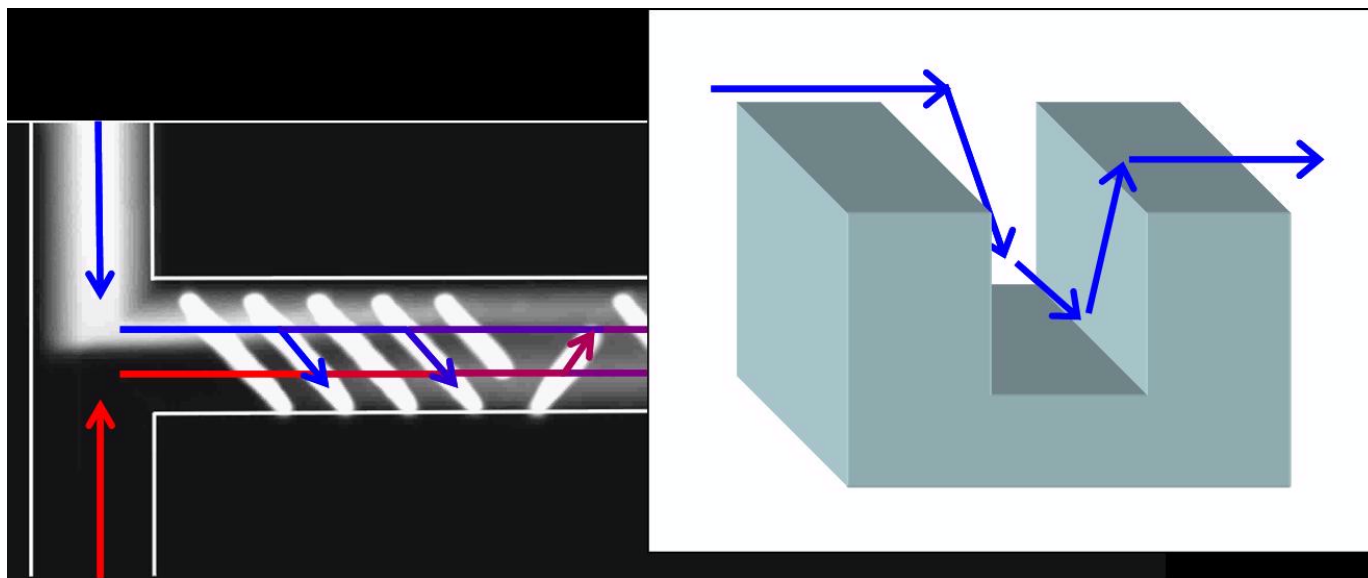
Achieve high flowrate microfluidic mixing using a short stream length

### Description

The majority of current mixing devices in microfluidic systems rely on diffusive mixing, where laminar flow effects and diffusion coefficient cause the reagents to mix. As a result, the mixing channel is typically extended to lengths that will ensure a completely mixed outlet stream. Although this approach is sufficient for low flowrates, for high flowrates ( $>1$  cm/s) or low analyte diffusion coefficients ( $<10^{-7}$  cm<sup>2</sup>/s) it would require excessively long mixing channels. The current invention can effectively mix two confluent laminar reagents within a very short stream length. It significantly decreases the channel length by placing wells in the flow channel at oblique angles to the axis flow. These wells are adjustable to tune the mix of the flows by adding more wells at different orientations, depths and with various electroosmotic mobility coatings, all of which may have a substantial effect on the performance of the invention. Additionally, it can be adapted to create two or more streams of equal or non-equal proportions of reagents. Finally, the invention is capable of doing serial dilution, which is when stream is separated multiple times resulting in several outlet streams with differing dilutions than the original. It is evident that this device is substantially better than other similar products on the market and is can be readily used by those in the microfluidic industry.

See continuation of U.S. patent application below under references.

### Images



Credit: NIST

### Applications

- **Serial dilutions**  
Manufactures streams of varying dilutions of a substance

### Advantages

- **Short stream lengths**  
Effectively mixes two confluent laminar reagents with high flow rates or low analyte diffusion coefficients
- **Wells**  
Wells used to significantly reduce the channel length can be adjusted to tune mixing flows by adding more or deeper wells in various positions

### Abstract

Disclosed is an apparatus and method for the mixing of two microfluidic channels wherein several wells are oriented diagonally across the width of a mixing channel. The device effectively mixes the confluent streams with electrokinetic flow, and to a lesser degree, with pressure driven flow. The device and method may be further adapted to split a pair of confluent streams into two or more streams of equal or non-equal concentrations of reactants. Further, under electrokinetic flow, the surfaces of said wells may be specially coated so that the differing electroosmotic mobility between the surfaces of the wells and the surfaces of the channel may increase the mixing efficiency. The device and method are applicable to the steady state mixing as well as the dynamic application of mixing a plug of reagent with a confluent stream.

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### Citations

1. **NIST Docket Number:** 01-034 Continuation  
[U.S. Patent # 7,658,536](#)

### Related Items

- PowerPoint Presentation: Microfluidic Mixing

### References

- U.S. Patent # 6,907,895
- Docket: 01-034US

### Status of Availability

This invention is available for licensing.

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